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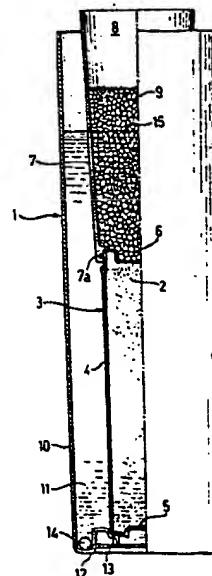
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⑲ Method and apparatus for regenerating the resin content of a water-softener cartridge.

⑳ The resin content (2) of a water-softener cartridge (3) is regenerated by: attaching a collar (7) to the upper, perforated end (6) of the cartridge casing (4), arranged vertically, and placing salt (9) in the container so formed; and lowering the cartridge (3) into a receptacle (10) containing sufficient soft, still water (11) for the water to rise through the perforated bottom (5) of the cartridge (3) and immerse the entire resin content and part of the salt contained in the collar. The apparatus is left for the front of the saline solution formed in the collar to progress downwardly through the cartridge to regenerate the entire resin content thereof.



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Method and apparatus for regenerating the resin content  
of a water-softener cartridge

The present invention relates to a method and apparatus for regenerating the resin content of a cartridge of a water softener, particularly for an espresso coffee machine, by means of a saline solution. According to

5 the known methods at present in use, exhausted cartridges of cartridge water softeners are regenerated by immersion of the cartridges in a receptacle containing an aqueous saline solution and keeping them there for a certain period of time.

10 Such methods of regeneration, although generally satisfactory, have several recognised disadvantages.

As well as being expensive, they do not result in the complete regeneration of the cartridges. In fact, from 15 tests carried out, it has been found that a cartridge regenerated in this manner is again exhausted after the passage of a much smaller quantity of hard water than that which caused the exhaustion of the new cartridge.

In addition, the water leaving a cartridge which has just been regenerated is considerably harder than the 20 water leaving a new cartridge. Thus, cartridges regenerated by the conventional regeneration methods have a shorter working life between two successive regenerations and soften the water to a lesser extent.

As a result of this, the practice of throwing away 25 exhausted cartridges has become widespread.

The problem which is at the root of the present invention is that of devising a regeneration method which

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is able to overcome the disadvantages cited with reference to the known art. This problem is resolved by a method of the type specified which is characterised in that it comprises the following steps:

- 5        - arranging the cartridge in a vertical position, and immersing the resin content totally in soft water such that a free surface of the soft water is formed above the resin in the cartridge; and
- 10        - forming a saline solution continuously in the region of the said free surface, the front of the saline solution progressing downwardly through the cartridge to regenerate the resin.

The formation of the free surface of soft water above the resin is, to advantage, achieved by feeding water into the cartridge from its lower end, with a rising feed.

Further characteristics and advantages of the invention will become apparent from the following description of one embodiment given by way of non-limiting example, 20 with reference to the appended drawing which is a partially-sectioned, elevational view of apparatus for carrying out the method of the invention.

Referring to the appended drawing, by 1 is indicated in its entirety, apparatus for carrying out a method 25 according to the invention for regenerating the resin content 2 of a cartridge 3 of a cartridge water softener which is not shown since it is conventional.

The cartridge 3 comprises a cylindrical casing 4 provided at one end with a perforated base wall 5 and at the other end with a perforated head 6. The cartridge 3 encloses within it the resin 2.

The apparatus 1 includes a collar 7 releasably attached to the head end of the cartridge 3 so as to prolong the casing 4. A toroidal washer 7a is interposed between the collar 7 and the casing 4 to ensure a fluid-

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tight seal between the collar 7 and the casing 4.

Together with the head 6 the collar 7 defines a space 8 for receiving a predetermined quantity of salt 9.

The apparatus 1 further includes a transparent 5 cylindrical receptacle 10 containing a predetermined quantity of soft water 11.

The receptacle 10 has a cross section such as to accommodate the cartridge 3 disposed vertically within it with the head end, to which the collar 7 is attached, 10 uppermost and the base end bearing on the bottom 12 of the receptacle and in fluid communication therewith. The receptacle 10 has, to advantage, raised projections 13 on the bottom 12 for supporting the cartridge 3 above the bottom itself.

15 : The receptacle 10 has substantially the same height as the total height of the cartridge 3 and the collar 7.

The receptacle 10 also contains a spherical body 14 which is visible from the exterior of the receptacle 10, and which has a density between that of soft water and that 20 ; of a saline solution which is formed as described below.

The use of the apparatus 1 in regenerating an exhausted cartridge 3 taken from a cartridge water softener will now be described.

Firstly, the collar 7 is fitted to the cartridge 3, 25 which is placed vertically, and a predetermined quantity of salt 9 is introduced into the space 8. The cartridge is then placed in the receptacle 10 which contains a predetermined quantity of soft, still water.

The water in the receptacle 10 rises within the 30 cartridge 3, with a rising feed, by passing through the perforated base wall 5, until it again becomes still.

The quantity of soft water contained in the receptacle 10 is chosen so that when the cartridge 3 is resting firmly 35 on the projections 13, it forms a free surface 15 of soft, still water with the resin 2 totally immersed in the water and consequently with immersion of at least part of the salt 9 in the space 8.

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As a result of the contact which is established at the said free surface between the soft water and the salt 9 contained in the space 8, a saline solution forms continuously, the front of which propagates downwardly, 5 gradually saturating the mass of soft still water enclosed in the cartridge, and progressing as the ion exchange reaction with the resin is completed.

The front of the saline solution, having passed through the entire cartridge, reaches the base wall 5 10 and passes into the receptacle 10. Here it encounters the spherical body 14 which, because of gravity is deposited on the bottom 12 of the receptacle 10, and thrusts it upwardly by fluid pressure. The rising of the spherical body 14 from the bottom 12 indicates the 15 completion of the regeneration of the cartridge.

By repeated comparative tests carried out on cartridges regenerated by the traditional method and on cartridges regenerated by the method according to the present invention, it is found that the quantity of water softened 20 in the interval between two successive regenerations increases from 80 litres for the first tests to 180 litres for the second tests while the degree of hardness of the water leaving the cartridges which have just been regenerated decreases from 2° for the first tests to 1° 25 for the second tests. The cartridges regenerated by the method according to the invention give results which are practically identical to those of new cartridges.

The main advantage of the method of regeneration according to the present invention lies in the fact that 30 the cartridges are given a longer working life between successive regenerations and a greater softening power.

Moreover, with this method, the regenerating operation is continued only for the time strictly necessary. Finally, wastage of prime materials is avoided in that 35 the water and salt are used only in the quantities strictly necessary for the regeneration.

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CLAIMS

1. Method of regenerating the resin content (2) of a water-softener cartridge (3) by means of a saline solution, characterised in that it includes the following steps:

- arranging the cartridge in a vertical position and immersing the resin content totally in soft water (11) such that a free surface (15) of the soft water is formed above the resin in the cartridge; and

- forming a saline solution continuously in the region of the said free surface, the front of the saline solution progressing downwardly through the cartridge to regenerate the resin.

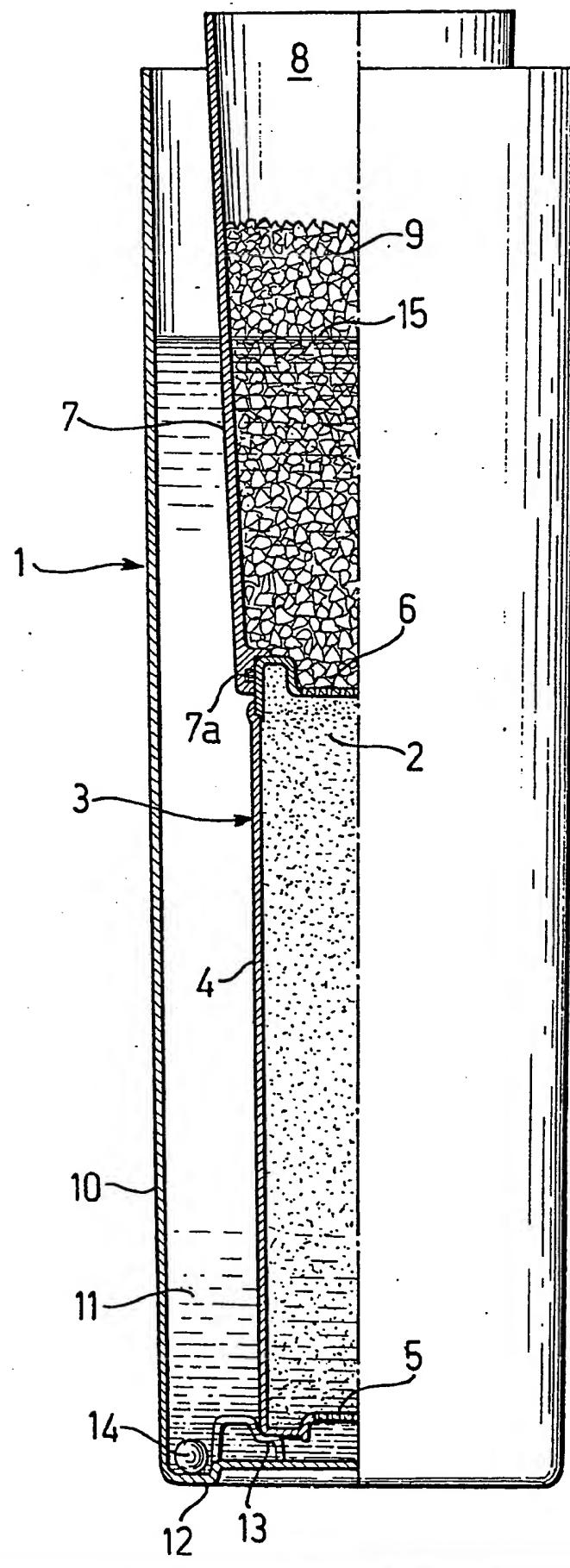
2. Method according to Claim 1, characterised in that the formation of the free surface (15) of soft water is achieved by feeding water into the cartridge from its lower end (5), with a rising feed.

3. Apparatus for regenerating the resin content (2) of a cartridge (3) of a cartridge-type water softener by the method of Claims 1 or 2, characterised in that it comprises a collar (7), releasably attachable to one end (6) of the cartridge (3) so as to prolong the cartridge casing (4) and form a fluid-tight seal therewith, the collar, in use, defining a space (8) for receiving a predetermined quantity of salt (9), and a receptacle (10) for containing a predetermined quantity of soft water (11), the receptacle having a cross-section such as to accommodate the cartridge (3) disposed vertically within it with the end (6) to which the collar (7) is attached, in use, uppermost and with the other end (5) bearing on the bottom (12) of the receptacle, with the interior of the cartridge in fluid communication with the receptacle (10) through the said other end, and the receptacle having a height substantially equal to the total height of the cartridge (3) and of the collar (7).

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4. Apparatus according to Claim 3, characterised in that it further includes, for location in the said receptacle (10) in use, a visible body (14) having a density between the density of soft water and the density of the saline solution formed during effecting of the method.

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EUROPEAN SEARCH REPORT

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EP 81 83 0085

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |                   | CLASSIFICATION OF THE APPLICATION (Int. Cl.)  |
|--|---|-------------------|---|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim |   |
|  | <p><u>GB - A - 338 021 (BRENIL)</u><br/>* Page 2, lines 13-37 *</p> <p>---</p> <p><u>FR - E - 35 606 (ET. PHILLIPS &amp; PAIN)</u><br/>* Page 1, lines 51-54; page 2, lines 1-12 *</p> <p>---</p> <p><u>US - A - 2 033 533 (MOORE)</u><br/>* Page 2, right-hand column, lines 16-30 *</p> <p>---</p> <p>A <u>FR - A - 2 091 499 (FIRMA CHEMIE BRITA)</u></p> <p>A <u>NL - A - 294 445 (PHILIPS)</u></p> <p>A <u>FR - A - 2 158 586 (ESSWEIN)</u></p> <p>A <u>FR - A - 815 760 (LAVECH)</u></p> <p>-----</p> | 1,2               | B 01 J 49/00<br>C 02 F 1/42   |
|  |   |                   | TECHNICAL FIELDS SEARCHED (Int. Cl.)  |
|  |   |                   | B 01 J 49/00<br>C 02 F 1/41   |
|  |   |                   | CATEGORY OF CITED DOCUMENTS   |
|  |   |                   | <p>X: particularly relevant</p> <p>A: technological background</p> <p>O: non-written disclosure</p> <p>P: Intermediate document</p> <p>T: theory or principle underlying the invention</p> <p>E: conflicting application</p> <p>D: document cited in the application</p> <p>L: citation for other reasons</p> |
|  |   |                   | &: member of the same patent family,<br>corresponding document  |
| <input checked="" type="checkbox"/> The present search report has been drawn up for all claims |   |                   |   |
| Place of search  | Date of completion of the search  | Examiner          |   |
| The Hague  | 09-09-1981  | WENDLING          |   |

